

Docket No.AUS920000951US1

**METHOD FOR PROVIDING A DESCRIPTION OF A USER'S CURRENT
POSITION IN A WEB PAGE**

BACKGROUND OF THE INVENTION

5

1. Technical Field:

The present invention relates to computer network environments. More specifically, the present invention relates to accessing the content of a web page when a
10 visual display is not available.

2. Description of Related Art:

Information on the World Wide Web is typically made available by structuring the information into a visual
15 presentation. Hypertext Markup Language (HTML) is used by the web author to define the visual structure. The end user is presented with this information by viewing the information on a computer display, after the information has been rendered into a visual format by a
20 web browser (e.g. Netscape Navigator or Microsoft Internet Explorer).

However, the visual presentation of web pages is not accessible by people with vision impairments, nor is the content accessible by users who do not have a visual
25 display device available. A variety of software products are becoming available which enable non-visual access to the HTML pages. These products capture the web page content and then present an audible rendering of the web page. This is generally accomplished by using a
30 text-to-speech (TTS) technology to read the textual content.

In a non-visual web browser, the current position of

Docket No.AUS920000951US1

the TTS "cursor" in the document is called the Point of Regard (POR). In the absence of visual queues, however, it is often difficult for a user of an audible web browser to determine where the POR is within the current web page. For example, a sighted user viewing a web page might page down through a few screens and see that he is in the second paragraph following a header. The user can also use the visual position of a scroll bar to assess the position relative to the entire page. The visually impaired user (or a sighted user without a visual display), by contrast, may have arrived at the same point in the document after pressing the Scroll Down key several times, but he will have no idea what section he is in. It is easy for such a user to get lost within the document after he has been navigating within it for some time. The visually impaired user might lose track of his overall position within a document (top, middle or bottom), as well as what specific section of the document he is currently accessing. The user might also have problems determining what other content is surrounding the specific content being directly accessed.

Prior art in this area involves counting up every item in the web page and announcing the POR as an index within the total number of items on the page. For example, "Item 54 of 206 items". The running time for this approach is proportional to the number of items on the web page. In addition, the prior art does not provide specific description of the page contents.

Therefore, it would be desirable to have a method for audible description of a user's position in a web page that provides detail concerning web page contents and reduces processing time.

SUMMARY OF THE INVENTION

The present invention provides a method, program,
and apparatus for providing a description of current
5 position in an electronic document. The invention first
comprises parsing the electronic document into a parse
tree. When the system receives a command from the user
requesting current position in the electronic document,
an algorithm performs a walk up the parse tree, from the
10 current position to the root of the document. A position
response, containing nodes in the walk up the parse tree,
is constructed by the algorithm and reported to the user.

11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000
1001
1002
1003
1004
1005
1006
1007
1008
1009
1010
1011
1012
1013
1014
1015
1016
1017
1018
1019
1020
1021
1022
1023
1024
1025
1026
1027
1028
1029
1030
1031
1032
1033
1034
1035
1036
1037
1038
1039
1040
1041
1042
1043
1044
1045
1046
1047
1048
1049
1050
1051
1052
1053
1054
1055
1056
1057
1058
1059
1060
1061
1062
1063
1064
1065
1066
1067
1068
1069
1070
1071
1072
1073
1074
1075
1076
1077
1078
1079
1080
1081
1082
1083
1084
1085
1086
1087
1088
1089
1090
1091
1092
1093
1094
1095
1096
1097
1098
1099
1100
1101
1102
1103
1104
1105
1106
1107
1108
1109
1110
1111
1112
1113
1114
1115
1116
1117
1118
1119
1120
1121
1122
1123
1124
1125
1126
1127
1128
1129
1130
1131
1132
1133
1134
1135
1136
1137
1138
1139
1140
1141
1142
1143
1144
1145
1146
1147
1148
1149
1150
1151
1152
1153
1154
1155
1156
1157
1158
1159
1160
1161
1162
1163
1164
1165
1166
1167
1168
1169
1170
1171
1172
1173
1174
1175
1176
1177
1178
1179
1180
1181
1182
1183
1184
1185
1186
1187
1188
1189
1190
1191
1192
1193
1194
1195
1196
1197
1198
1199
1200
1201
1202
1203
1204
1205
1206
1207
1208
1209
1210
1211
1212
1213
1214
1215
1216
1217
1218
1219
1220
1221
1222
1223
1224
1225
1226
1227
1228
1229
1230
1231
1232
1233
1234
1235
1236
1237
1238
1239
1240
1241
1242
1243
1244
1245
1246
1247
1248
1249
1250
1251
1252
1253
1254
1255
1256
1257
1258
1259
1260
1261
1262
1263
1264
1265
1266
1267
1268
1269
1270
1271
1272
1273
1274
1275
1276
1277
1278
1279
1280
1281
1282
1283
1284
1285
1286
1287
1288
1289
1290
1291
1292
1293
1294
1295
1296
1297
1298
1299
1300
1301
1302
1303
1304
1305
1306
1307
1308
1309
1310
1311
1312
1313
1314
1315
1316
1317
1318
1319
1320
1321
1322
1323
1324
1325
1326
1327
1328
1329
1330
1331
1332
1333
1334
1335
1336
1337
1338
1339
1340
1341
1342
1343
1344
1345
1346
1347
1348
1349
1350
1351
1352
1353
1354
1355
1356
1357
1358
1359
1360
1361
1362
1363
1364
1365
1366
1367
1368
1369
1370
1371
1372
1373
1374
1375
1376
1377
1378
1379
1380
1381
1382
1383
1384
1385
1386
1387
1388
1389
1390
1391
1392
1393
1394
1395
1396
1397
1398
1399
1400
1401
1402
1403
1404
1405
1406
1407
1408
1409
1410
1411
1412
1413
1414
1415
1416
1417
1418
1419
1420
1421
1422
1423
1424
1425
1426
1427
1428
1429
1430
1431
1432
1433
1434
1435
1436
1437
1438
1439
1440
1441
1442
1443
1444
1445
1446
1447
1448
1449
1450
1451
1452
1453
1454
1455
1456
1457
1458
1459
1460
1461
1462
1463
1464
1465
1466
1467
1468
1469
1470
1471
1472
1473
1474
1475
1476
1477
1478
1479
1480
1481
1482
1483
1484
1485
1486
1487
1488
1489
1490
1491
1492
1493
1494
1495
1496
1497
1498
1499
1500
1501
1502
1503
1504
1505
1506
1507
1508
1509
1510
1511
1512
1513
1514
1515
1516
1517
1518
1519
1520
1521
1522
1523
1524
1525
1526
1527
1528
1529
1530
1531
1532
1533
1534
1535
1536
1537
1538
1539
1540
1541
1542
1543
1544
1545
1546
1547
1548
1549
1550
1551
1552
1553
1554
1555
1556
1557
1558
1559
1560
1561
1562
1563
1564
1565
1566
1567
1568
1569
1570
1571
1572
1573
1574
1575
1576
1577
1578
1579
1580
1581
1582
1583
1584
1585
1586
1587
1588
1589
1590
1591
1592
1593
1594
1595
1596
1597
1598
1599
1600
1601
1602
1603
1604
1605
1606
1607
1608
1609
1610
1611
1612
1613
1614
1615
1616
1617
1618
1619
1620
1621
1622
1623
1624
1625
1626
1627
1628
1629
1630
1631
1632
1633
1634
1635
1636
1637
1638
1639
1640
1641
1642
1643
1644
1645
1646
1647
1648
1649
1650
1651
1652
1653
1654
1655
1656
1657
1658
1659
1660
1661
1662
1663
1664
1665
1666
1667
1668
1669
1670
1671
1672
1673
1674
1675
1676
1677
1678
1679
1680
1681
1682
1683
1684
1685
1686
1687
1688
1689
1690
1691
1692
1693
1694
1695
1696
1697
1698
1699
1700
1701
1702
1703
1704
1705
1706
1707
1708
1709
1710
1711
1712
1713
1714
1715
1716
1717
1718
1719
1720
1721
1722
1723
1724
1725
1726
1727
1728
1729
1730
1731
1732
1733
1734
1735
1736
1737
1738
1739
1740
1741
1742
1743
1744
1745
1746
1747
1748
1749
1750
1751
1752
1753
1754
1755
1756
1757
1758
1759
1760
1761
1762
1763
1764
1765
1766
1767
1768
1769
1770
1771
1772
1773
1774
1775
1776
1777
1778
1779
1780
1781
1782
1783
1784
1785
1786
1787
1788
1789
1790
1791
1792
1793
1794
1795
1796
1797
1798
1799
1800
1801
1802
1803
1804
1805
1806
1807
1808
1809
1810
1811
1812
1813
1814
1815
1816
1817
1818
1819
1820
1821
1822
1823
1824
1825
1826
1827
1828
1829
1830
1831
1832
1833
1834
1835
1836
1837
1838
1839
1840
1841
1842
1843
1844
1845
1846
1847
1848
1849
1850
1851
1852
1853
1854
1855
1856
1857
1858
1859
1860
1861
1862
1863
1864
1865
1866
1867
1868
1869
1870
1871
1872
1873
1874
1875
1876
1877
1878
1879
1880
1881
1882
1883
1884
1885
1886
1887
1888
1889
1890
1891
1892
1893
1894
1895
1896
1897
1898
1899
1900
1901
1902
1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930
1931
1932
1933
1934
1935
1936
1937
1938
1939
1940
1941
1942
1943
1944
1945
1946
1947
1948
1949
1950
1951
1952
1953
1954
1955
1956
1957
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
2042
2043
2044
2045
2046
2047
2048
2049
2050
2051
2052
2053
2054
2055
2056
2057
2058
2059
2060
2061
2062
2063
2064
2065
2066
2067
2068
2069
2070
2071
2072
2073
2074
2075
2076
2077
2078
2079
2080
2081
2082
2083
2084
2085
2086
2087
2088
2089
2090
2091
2092
2093
2094
2095
2096
2097
2098
2099
2100
2101
2102
2103
2104
2105
2106
2107
2108
2109
2110
2111
2112
2113
2114
2115
2116
2117
2118
2119
2120
2121
2122
2123
2124
2125
2126
2127
2128
2129
2130
2131
2132
2133
2134
2135
2136
2137
2138
2139
2140
2141
2142
2143
2144
2145
2146
2147
2148
2149
2150
2151
2152
2153
2154
2155
2156
2157
2158
2159
2160
2161
2162
2163
2164
2165
2166
2167
2168
2169
2170
2171
2172
2173
2174
2175
2176
2177
2178
2179
2180
2181
2182
2183
2184
2185
2186
2187
2188
2189
2190
2191
2192
2193
2194
2195
2196
2197
2198
2199
2200
2201
2202
2203
2204
22

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the
5 invention are set forth in the appended claims. The
invention itself, however, as well as a preferred mode of
use, further objectives and advantages thereof, will best
be understood by reference to the following detailed
description of an illustrative embodiment when read in
10 conjunction with the accompanying drawings, wherein:

Figure 1 depicts a pictorial representation of a
network of data processing systems in which the present
invention may be implemented;

Figure 2 depicts a block diagram of a data processing
15 system that may be implemented as a server in accordance
with a preferred embodiment of the present invention;

Figure 3 depicts a block diagram illustrating a data
processing system in which the present invention may be
implemented;

Figure 4 depicts a block diagram of a browser
20 program in accordance with a preferred embodiment of the
present invention;

Figure 5 depicts a flowchart illustrating the
general steps of the present invention;

Figure 6 depicts a diagram illustrating a HTML parse
25 tree in accordance with the present invention; and

Figure 7 depicts a flowchart illustrating the
algorithm for constructing an audible position
identification in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference now to the figures, **Figure 1** depicts a
5 pictorial representation of a network of data processing
systems in which the present invention may be implemented.
Network data processing system **100** is a network of
computers in which the present invention may be
implemented. Network data processing system **100** contains
10 a network **102**, which is the medium used to provide
communications links between various devices and computers
connected together within network data processing system
100. Network **102** may include connections, such as wire,
wireless communication links, or fiber optic cables.

15 In the depicted example, a server **104** is connected to
network **102** along with storage unit **106**. In addition,
clients **108**, **110**, and **112** also are connected to network
102. These clients **108**, **110**, and **112** may be, for example,
personal computers or network computers. In the depicted
20 example, server **104** provides data, such as boot files,
operating system images, and applications to clients
108-112. Clients **108**, **110**, and **112** are clients to server
104. Network data processing system **100** may include
additional servers, clients, and other devices not shown.

25 In the depicted example, network data processing
system **100** is the Internet with network **102** representing a
worldwide collection of networks and gateways that use the
TCP/IP suite of protocols to communicate with one another.
At the heart of the Internet is a backbone of high-speed
30 data communication lines between major nodes or host
computers, consisting of thousands of commercial,
government, educational and other computer systems that

Docket No.AUS920000951US1

route data and messages. Of course, network data processing system 100 also may be implemented as a number of different types of networks, such as for example, an intranet, a local area network (LAN), or a wide area network (WAN). **Figure 1** is intended as an example, and not as an architectural limitation for the present invention.

Referring to **Figure 2**, a block diagram of a data processing system that may be implemented as a server, such as server 104 in **Figure 1**, is depicted in accordance with a preferred embodiment of the present invention.

Data processing system 200 may be a symmetric multiprocessor (SMP) system including a plurality of processors 202 and 204 connected to system bus 206.

Alternatively, a single processor system may be employed.

Also connected to system bus 206 is memory controller/cache 208, which provides an interface to local memory 209. I/O bus bridge 210 is connected to system bus 206 and provides an interface to I/O bus 212. Memory controller/cache 208 and I/O bus bridge 210 may be integrated as depicted.

Peripheral component interconnect (PCI) bus bridge 214 connected to I/O bus 212 provides an interface to PCI local bus 216. A number of modems may be connected to PCI bus 216. Typical PCI bus implementations will support four PCI expansion slots or add-in connectors.

Communications links to network computers 108-112 in **Figure 1** may be provided through modem 218 and network adapter 220 connected to PCI local bus 216 through add-in boards.

Additional PCI bus bridges 222 and 224 provide interfaces for additional PCI buses 226 and 228, from

Docket No.AUS920000951US1

which additional modems or network adapters may be supported. In this manner, data processing system 200 allows connections to multiple network computers. A memory-mapped graphics adapter 230 and hard disk 232 may
5 also be connected to I/O bus 212 as depicted, either directly or indirectly.

Those of ordinary skill in the art will appreciate that the hardware depicted in **Figure 2** may vary. For example, other peripheral devices, such as optical disk
10 drives and the like, also may be used in addition to or in place of the hardware depicted. The depicted example is not meant to imply architectural limitations with respect to the present invention.

The data processing system depicted in **Figure 2** may
15 be, for example, an IBM RISC/System 6000 system, a product of International Business Machines Corporation in Armonk, New York, running the Advanced Interactive Executive (AIX) operating system.

With reference now to **Figure 3**, a block diagram
20 illustrating a data processing system is depicted in which the present invention may be implemented. Data processing system 300 is an example of a client computer. Data processing system 300 employs a peripheral component interconnect (PCI) local bus architecture. Although the
25 depicted example employs a PCI bus, other bus architectures such as Accelerated Graphics Port (AGP) and Industry Standard Architecture (ISA) may be used.

Processor 302 and main memory 304 are connected to PCI local bus 306 through PCI bridge 308. PCI bridge 308 also
30 may include an integrated memory controller and cache memory for processor 302. Additional connections to PCI local bus 306 may be made through direct component

interconnection or through add-in boards. In the depicted example, local area network (LAN) adapter **310**, SCSI host bus adapter **312**, and expansion bus interface **314** are connected to PCI local bus **306** by direct component connection. In contrast, audio adapter **316**, graphics adapter **318**, and audio/video adapter **319** are connected to PCI local bus **306** by add-in boards inserted into expansion slots. Expansion bus interface **314** provides a connection for a keyboard and mouse adapter **320**, modem **322**, and additional memory **324**. Small computer system interface (SCSI) host bus adapter **312** provides a connection for hard disk drive **326**, tape drive **328**, and CD-ROM drive **330**. Typical PCI local bus implementations will support three or four PCI expansion slots or add-in connectors.

An operating system runs on processor **302** and is used to coordinate and provide control of various components within data processing system **300** in **Figure 3**. The operating system may be a commercially available operating system, such as Windows 2000, which is available from Microsoft Corporation. An object oriented programming system such as Java may run in conjunction with the operating system and provide calls to the operating system from Java programs or applications executing on data processing system **300**. "Java" is a trademark of Sun Microsystems, Inc. Instructions for the operating system, the object-oriented operating system, and applications or programs are located on storage devices, such as hard disk drive **326**, and may be loaded into main memory **304** for execution by processor **302**.

Those of ordinary skill in the art will appreciate that the hardware in **Figure 3** may vary depending on the implementation. Other internal hardware or peripheral

Docket No.AUS920000951US1

devices, such as flash ROM (or equivalent nonvolatile memory) or optical disk drives and the like, may be used in addition to or in place of the hardware depicted in **Figure 3**. Also, the processes of the present invention
5 may be applied to a multiprocessor data processing system.

As another example, data processing system **300** may be a stand-alone system configured to be bootable without relying on some type of network communication interface,
10 whether or not data processing system **300** comprises some type of network communication interface. As a further example, data processing system **300** may be a Personal Digital Assistant (PDA) device, which is configured with ROM and/or flash ROM in order to provide non-volatile
15 memory for storing operating system files and/or user-generated data.

The depicted example in **Figure 3** and above-described examples are not meant to imply architectural limitations. For example, data processing system **300**
20 also may be a notebook computer or hand held computer in addition to taking the form of a PDA. Data processing system **300** also may be a kiosk or a Web appliance.

Turning next to **Figure 4**, a block diagram of a browser program is depicted in accordance with a
25 preferred embodiment of the present invention. Browser **400** includes a user interface **402**, which is a graphical user interface (GUI) that allows the user to interface or communicate with browser **400**. This interface provides for selection of various functions through menus **404** and
30 allows for navigation through the navigation input **410**. For example, menu **404** may allow a user to perform various functions, such as saving a file, opening a new window,

displaying a history, and entering a URL. Navigation **410** allows for a user to navigate various pages and to select web sites for viewing. For example, navigation **410** may allow a user to see a previous page or a subsequent page relative to the present page. Navigation **410** may also have voice recognition capabilities. Preferences may be set through preferences **406**. Browser **400** also contains text-to-speech (TTS) **408**, which converts text data into auditory signals.

Communications **412** is the mechanism with which browser **400** receives documents and other resources from a network such as the Internet. Further, communications **412** is used to send or upload documents and resources onto a network. In the depicted example, communication **412** uses HTTP. However, other protocols are possible. Documents that are received by browser **400** are processed by language interpretation **414**, which includes an HTML unit **416**, and a parser **418** which is capable of generating a parse tree associated with an electronic document, as discussed below in reference to **Figure 6**. Language interpretation **414** will process a document for presentation on graphical display **420**. In particular, HTML statements are processed by HTML unit **416** for presentation.

Graphical display **420** includes layout unit **422**, rendering unit **424**, and window management **426**. These units are involved in presenting web pages to a user based on results from language interpretation **414**.

Browser **400** is presented as an example of a browser program in which the present invention may be embodied. Browser **400** is not meant to imply architectural

limitations to the present invention. Presently available browsers may include additional functions not shown or may omit functions shown in browser 400. As used herein, the term "browser" encompasses any software application used to view or navigate for information or data (e.g. something that assists a user to browse) in a distributed data base where the distributed database is typically the internet or World Wide Web.

The present invention allows users with visual impairments, or those without a visual display, to access the contents of electronic documents. Users without visual displays might include, for example, those accessing the internet via cell phone while driving a car. The present invention is faster than the prior art in this area and provides more descriptive information to the user. The present invention is also applicable to document technologies other than HTML, such as Extensible Markup Language (XML).

Referring to **Figure 5**, a flowchart illustrates the general steps of the present invention. When an electronic document, such as a web page, is downloaded by browser 400, parser 418 creates a parse tree (step 501). The details of the parse tree are described below in reference to **Figure 6**. The system then receives a command from the user requesting information about the cursor's position within the electronic document (step 502). This request may be made by means of any input device, such as for example, keyboard or voice command. In response to the user request, the system constructs an audible response by walking up the parse tree (step 503). This audible response is then delivered to the user by means of a speaker (step 504).

Referring now to **Figure 6**, a diagram illustrating an exemplary HTML parse tree is depicted in accordance with the present invention. The present invention describes the cursor position in an electronic document (i.e. web page) by walking the HTML parse tree, from the current TTS position to the root of the document. HTML, which is used to provide a visual structure to the page, can also provide a semantic structure to the page. For example, the HTML markup defines which ranges of text are contained under which heading, or within an item in a list, or within a table. Well known techniques exist for parsing an HTML source file into a parse tree. The various elements and relationships among elements are then apparent from the topology of the parse tree.

The root of the document is the BODY **601**. The body consists of several major sections **611-613**, each tagged as a Heading 1 (H1). The second H1 section is titled "Wines" **612**, which consists of three subsections **621-623** tagged as Heading Level 2 (H2). One of these H2 subsections **621** is titled "California Wines". One of the paragraphs **631-633** in subsection **621** contains a table **633** with the title "California winemakers", and so forth. A "Where Am I" algorithm constructs an audible position identification (using TTS) by walking up the parse tree **600**, from the tree node associated with the current POR to the root **601** of the document.

Referring to **Figure 7**, a flowchart illustrating the algorithm for constructing an audible position identification is depicted in accordance with the present invention. The first step in the algorithm is to determine if cursor is presently positioned at the root node (step **701**). If the current node is the root node,

then the algorithm sets the string variable
'resultString' to "Top of document" or "Bottom of
document" and the algorithm terminates and 'resultString'
contains the "Where Am I" result (step 702). If the
5 current node is not the root node, 'resultString' is
initialized to an empty string, and the reference
variable 'currentNode' is initialized to the parse tree
node associated with the current POR (step 703).

The algorithm next constructs a string which
10 describes the tree node which is referenced by the
variable 'currentNode' (step 704). For example, if
'currentNode' references the node labeled 651 in **Figure**
6, the algorithm could construct a string which prefixes
the phrase "Table cell containing: " to the actual
15 contents of that table cell, which is "Robert Mondavi".
For other types of HTML elements, other phrase generating
rules could be used. For example, if 'currentNode' is
set to the node labeled 642, a TABLE ROW node, the tree
could be traversed to determine which row this node
20 represents in the parse tree. For node 642, the row
represented is the second row. Therefore, the algorithm
could construct the string "Row 2".

The string constructed in step 704 is then appended
to 'resultString', including an appropriate separator
25 character, such as a period or semicolon (step 705). The
algorithm then traverses one level in the parse tree
(step 706). First, a reference to the parent of the node
referenced by 'currentNode' is obtained. For example, in
Figure 6, if 'currentNode' references the node labeled
30 642, the parentNode would be set to reference the node
labeled 633. After the reference to the parent node is
saved in 'parentNode', the algorithm sets 'currentNode'

Docket No.AUS920000951US1

to reference the same node as 'parentNode'. The current node reference has now moved up one level in the parse tree.

Again, the algorithm checks if the node referenced
5 by 'currentNode' is currently located at the root node (step 707). If the current node is the root node, the algorithm ends and 'resultString' contains the "Where Am I" result. If the current node is not the root node, the algorithm returns to step 704.

10 Therefore, in the present example, the following string might be constructed:

Current POR is:

Table call containing: "Robert Mondavi".

15 Row 2.

In table titled: "California winemakers by annual production".

Under Heading 2 section titled: "California wines".

Under Heading 1 section titled: "Wines".

20

The "Where Am I" algorithm would respond to a user request for WAI information. This request may be by means of any input device, such as, for example, voice command or keyboard.

25 The present invention confers a number of advantages. It is more descriptive and intuitive than the prior art. It accommodates documents which are changed dynamically, whereas the prior art does not. It is very common for the content of web pages to be updated
30 dynamically by active scripting technologies, such as JavaScript. Current browser technology (i.e. MS IE 5.0+, Mozilla) maintains the parse tree that is associated with the current web page being accessed by the user, and

Docket No.AUS920000951US1

dynamically updates this tree when the web page is changed.

The present invention is also faster than the prior art. A technique which counts every item on the page, such as is found in the prior art, requires a running time which is proportional to the number of items on the page. Web pages can change dynamically. Under prior art, when a WAI request is processed, every element on the page must be visited (and counted) to determine the index of the current POR and the total number of items on the page. If there are "n" items on the page, the running time of the algorithm will be bounded by the function "a*n", where "a" is some positive real number. Formally, this is called an $O(n)$ performance bound (Reference: *Introduction to Algorithms*, Cormen, Leiserson, and Rivest, ISBN 0-262-53091-0, 1997. Chapter 2, "Growth of Functions"). The algorithm defined by the present invention does not need to visit every element in the web page to determine WAI. Instead, it visits only a very small number of nodes: each of its ancestor nodes from current position to the root of the tree. This number of nodes is no larger than the height of the tree. As described in the cited *Algorithms* text, Section 13.4 "Randomly built binary search trees", the height of a randomly built tree is a function of $\log(n)$, where "n" is the number of nodes in the tree (which is the same as the number of elements in the web page). Therefore, the present invention improves running time from $O(n)$ to $O(\log(n))$, which is an exponential improvement in speed.

In practice, additional rules of thumb might be appropriate to determine which elements should be announced (and which should not) in the course of the walk from the current POR tree node to the root. For

Docket No.AUS920000951US1

example, elements such as SPAN (which specifies a non-visible formatting division) might not be announced. SPAN is used by HTML authors to identify a block of HTML. As another example, if the current position is in a table
5 with one row and one column, the algorithm could include a rule of thumb that specifies that such tables are not announced.

The present invention is also applicable to any XML or Direct Object Model (DOM) technology. HTML technology
10 has been generalized into a more formal, and more widely applicable technology called Extensible Markup Language (XML). Whereas HTML provides a structure only for visual layout of web pages, XML provides a mechanism for defining the structure and meaning of data in a
15 generalized document definition language. XML is being applied to a wide problem domain, and is applicable wherever information needs to be exchanged between independent information systems. The most recent HTML definitions have redefined HTML as an instance of XML
20 document definition technology. A DOM is the parse tree for an XML document. The present invention for audible description of the position of a document cursor within a HTML document is applicable to any XML document as well. The POR can be constructed by visiting each node in the
25 DOM which is on the path from the current position to the root of the tree. At each node, the XML tag name and value would be announced.

Several versions of a response might be used to further improve the utility of the "Where Am I"
30 algorithm. A "verbose" response would provide all the information available from a complete walk up the parse tree, from current position to the document root. While this response would be the most informative, it may

Docket No.AUS920000951US1

provide more information than the user wants, particularly if the user queries his position several times from adjacent positions in the document.

5 A "terse" response would provide an alternative. In this case, position information would be gathered only by examining the first few immediate parents of the current parse tree node. A threshold value might be set by the user, which would control how much of the parse tree would be examined for position information. The position
10 algorithm would only walk up the predefined number of parents in the parse tree, or to the root, whichever comes first.

A "delta" response provides yet another alternative. Under this approach, the "Where Am I" facility would
15 maintain variables which track the parse tree location of the last "Where Am I" query, and the verbose response that would be constructed at that location. When a new "Where Am I" query arrives, a verbose response is constructed for the new location. Then the responses for
20 the old and new locations are compared, and only those elements which are different are reported to the user. It should be noted that this is a computationally efficient approach, because only the two paths from location to root need to be compared in order to
25 determine which nodes are different.

The example used in describing the present invention has focused primarily on providing the user with an audible position response. However, the present
30 invention need not be limited to an audible announcement of cursor position. The position could be communicated through a tactile feedback mechanism such as a braille display. The present invention might also be used in a

Docket No.AUS920000951US1

visual display that is not a graphical browser. For example, a text-only browser might be used, which does not format or arrange text within a graphical layout, but rather displays the text part of a web page as a
5 character stream.

It is important to note that while the present invention has been described in the context of a fully functioning data processing system, those of ordinary skill in the art will appreciate that the processes of
10 the present invention are capable of being distributed in the form of a computer readable medium of instructions and a variety of forms and that the present invention applies equally regardless of the particular type of signal bearing media actually used to carry out the
15 distribution. Examples of computer readable media include recordable-type media, such as a floppy disk, a hard disk drive, a RAM, CD-ROMs, DVD-ROMs, and transmission-type media, such as digital and analog communications links, wired or wireless communications
20 links using transmission forms, such as, for example, radio frequency and light wave transmissions. The computer readable media may take the form of coded formats that are decoded for actual use in a particular data processing system.

25 The description of the present invention has been presented for purposes of illustration and description, and is not intended to be exhaustive or limited to the invention in the form disclosed. Many modifications and
30 variations will be apparent to those of ordinary skill in the art. The embodiment was chosen and described in order to best explain the principles of the invention, the practical application, and to enable others of

ordinary skill in the art to understand the invention for various embodiments with various modifications as are suited to the particular use contemplated.